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EXAMINER	
HON, SOW FUN	
ART UNIT	PAPER NUMBER
1772	

DATE MAILED: 08/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/656,578	LAZAREV ET AL.	
	Examiner	Art Unit	
	Sow-Fun Hon	1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) *41-48* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,5-11,14,17-22,25-29 and 34-39* is/are rejected.

7)☒ Claim(s) *3,4,12,13,15,16,23,24,30-33 and 40* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *05/14/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims1-40, drawn to an article, classified in class 428, subclass 1.31.

II. Claims 41-48, drawn to a process, classified in class 438, subclass 82.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the organic photoelectric layer may be made via molecular self-assembly from solution on the substrate instead of the Cascade Crystallization Process.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Tianjun Hou on May 13, 2004 a provisional election was made with traverse to prosecute the invention of Group, claim I. Affirmation of this election must be made by applicant in replying to this Office action. Claims 41-48 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 11-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 11, on which claims 12-13 depend, recites the limitation which should be rewritten to include the additional clarifying term in italics: "... formed on one part of a *front* surface of the organic electrode facing ... formed on another part of said front surface ...". Otherwise, it would be unclear whether the front surface is different from the surface mentioned before.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

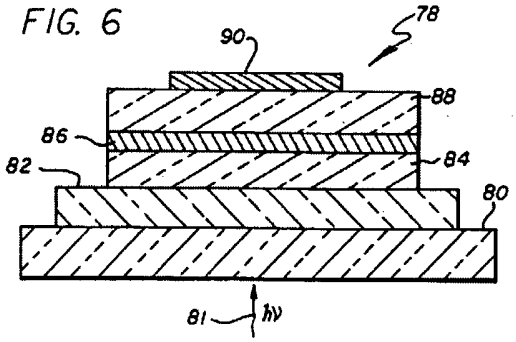
> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1-2 are rejected under 35 U.S.C. 102(b) as being anticipated by Forrest et al. (US 5,315,129).

Regarding claim 1, Forrest et al. has an organic optoelectronic device (abstract) comprising a multilayer structure (see Fig. 6 below).

FIG. 6



The multilayer structure comprises a first electrode layer (transparent conducting back contact 82) (column 8, lines 25-30), a second electrode layer (top contact 90) (column 8, lines 40-45), and at least one organic layer of PTCDA (column 8, lines 30-35).

Fig. 1 below of Forrest et al. shows the molecular structure of PTCDA to be polycyclic with a conjugated π-system.

PTCDA

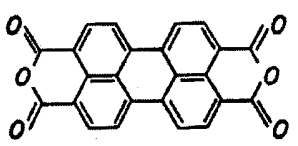


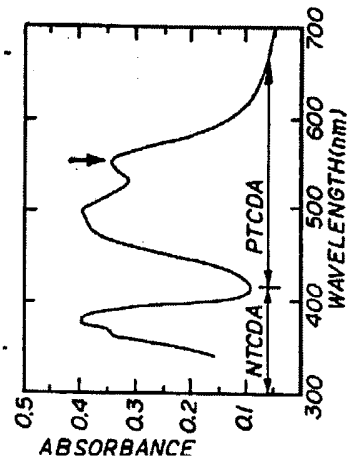
FIG. 1

PTCDA is short for 3,4,9,10-perylenetetracarboxylic dianhydride. This organic compound is equivalent to 3,4,9,10-perylenetetracarboxylic-bis-benzimidazole (PB) as an

organic material which transports holes (column 2, lines 35-45). 3,4,9,10-perylenetetracarboxylic-bis-benzimidazole (PB) is a homolog of 3,4,9,10-perylenetetracarboxylic-bis-imidazole (PTCBI), sans the benzene derivatization, which is photoelectric, forms rodlike supramolecules, and the layer of molecules inherently has a globally ordered crystal structure with an intermolecular spacing along a polarization axis of the layer, as defined by Applicant's specification (page 37, lines 20-25 and page 35, lines 25-30). Thus the organic layer in Fig. 6 of Forrest et al., on the previous page, inherently is photoelectric, is comprised of rodlike supramolecules, and has a globally ordered crystal structure with an intermolecular spacing along a polarization axis of the layer. The interplanar spacing is the spacing between the planes of molecular layers in the stack (column 4, lines 15-16) and thus is the intermolecular spacing along a polarization axis of the organic photoelectric layer. PTCDA has an interplanar spacing of 3.21Å (column 4, lines 15-20), which is within the claimed range of 3.4 ± 0.3 Å.

Fig. 6 of Forrest et al., on the previous page, shows that the multilayer structure 78 is formed on one side of glass substrate 80 (column 8, lines 25-35). The first electrode layer is ITO (column 8, line 30), which is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive, as defined by Applicant's specification (page 43, lines 20-30).

PTCDA is anisotropically absorbing (column 2, lines 5-10) and electrically conducting (column 4, lines 15-20). Fig. 4B on the next page shows that the organic layer (PTCDA) absorbs electromagnetic radiation in a predetermined range of 400 to 700 nm, which is in the claimed range of approximately 200 to 3000 nm.



Regarding claim 2, Fig. 6 of Forrest et al., on the previous page, shows that the organic photoelectric layer 84, 86 or 88 is located between the first 82 and second 90 electrodes. Said first transparent electrode 82 faces the transparent substrate through which the photons 81 enter (column 8, lines 25-30), located between the source of electromagnetic radiation (photons 81) and the organic photoelectric layer 84, 86 or 88, acting as the front electrode. Electrode 90 is thus the corresponding rear second electrode.

10. Claims 1, 14, 27-29, 34-35, 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Forrest et al. (US 6,198,091).

Regarding claims 1, 27, 34, Forrest et al. teaches an organic photosensitive optoelectronic device comprising a system of organic photovoltaic subcells (column 23, lines 35-40) superimposed on each other (stacked) (column 24, line 17) and electrically connected in parallel (claim 27) or in series (claim 34) (column 24, lines 10-15), interconnected by electrode layers (column 24, lines 20-25) (claim 34). The electrode layers may be formed of silver (Ag) (column 5, lines 20-25), and function as electron-hole recombination zones, as defined by the specification (page 38, lines 1-5, 25-30). Thus the photovoltaic subcells are separated by electron-hole recombination zones (claim 34). Forrest et al. teaches that each cell comprises at

least one pair of electrodes, a first electrode that serves as a cathode and a second electrode that serves as an anode (column 10, lines 15-20).

In Fig. 9 of Forrest et al., layer 903 is in contact with layer 904. Layer 903 may comprise PTCDA or PTCBI (column 23, lines 40-50). 3,4,9,10-perylenetetracarboxylic-bis-benzimidazole (PTCBI) is a homolog of 3,4,9,10-perylenetetracarboxylic-bis-imidazole (PTCBI), sans the benzene derivatization, which, as defined by Applicant's specification (page 37, lines 20-25 and page 35, lines 25-30) is a polycyclic organic compound with a conjugated π-system, and inherently is anisotropically absorbing, is electrically conducting, is comprised of rodlike supramolecules, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm.

Forrest et al. teaches that PTBCI is hole transporting (HTL) while CuPc is conversely electron transporting (ETL) (column 22, line 65). PTBCI acts as an electron acceptor as defined by Applicant's specification (page 37, lines 20-25), hence CuPc acts conversely as an electron donor. Substrate 010 supports said first ITO electrode 902 (column 23, lines 35-40) and said second ITO electrode 907 (column 23, lines 45-50). Fig. 9 shows that the system of organic photovoltaic elements is formed on one side of the substrate (claim 27). ITO is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive, as defined by Applicant's specification (page 43, lines 20-30).

Regarding claim 14, Forrest et al. teaches that there is a photovoltaic heterojunction between two organic layers (organic bilayer) (column 6, lines 50-55), one layer comprised of

CuPc contacting the other layer comprised of PTCBI (column 7, lines 1-10). Forrest et al. teaches that PTBCI is hole transporting (HTL) while CuPc is conversely electron transporting (ETL) (column 22, line 65). PTBCI acts as an electron acceptor as defined by Applicant's specification (page 37, lines 20-25), hence CuPc acts conversely as an electron donor. Forrest et al. teaches that one embodiment comprises a PTCBI/CuPc pair (column 26, lines 45-50), located between two electrodes 10A02 and 10A05 in Fig. 10A. Although the electromagnetic radiation is not depicted in Fig. 10A, penetration by electromagnetic radiation is taught (column 27, lines 6-12). Hence one of the two electrodes is inherently the first electrode located between a source of the electromagnetic radiation and said organic photoelectric layers and is a front electrode, while the second electrode is by default the corresponding rear electrode.

Regarding claim 29, Forrest et al. teaches a transparent isolating (insulating) layer positioned between said organic photovoltaic elements (subcells separated or isolated) (column 24, lines 1-15).

Regarding claim 35, Forrest et al. teaches that each subcell produces approximately the same current so as to reduce inefficiency (column 14, lines 5-15). Thus the values of the currents generated by each subcell are approximately equal.

Regarding claims 28, 39, Forrest et al. teaches that the photoelectric (photoconductive) materials are chosen for their ability (property) to absorb an electromagnetic radiation in predetermined spectral ranges (column 2, lines 1-10), which is why materials like PTBCI are chosen (column 23, lines 40-50). PTBCI is a homolog of 3,4,9,10-perylenetetracarboxylic-bis-imidazole (PTCBI), sans the benzene derivatization, which, as defined by Applicant's

specification (page 37, lines 20-25 and page 35, lines 25-30) inherently absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1-2, 5-7, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al. (US 5,315,129).

Regarding claims 1-2, '129 has been discussed above, and teaches an organic optoelectronic device comprising a multi-layer structure comprised of a first electrode layer, a second electrode layer, and at least one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, is inherently comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm, wherein the multi-layer structure is formed on one side of a substrate, and at least one of said first and second electrodes is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive.

Regarding claims 5-6, although Forrest et al. fails to teach which electrode is the cathode and which is the anode, it is notoriously well known in the art that when the front electrode serves as a cathode, the rear electrode serves as the corresponding anode (claim 5) and vice versa when the front electrode serves as the anode (claim 6), depending on the direction of the bias voltage.

Regarding claim 7, Forrest et al. teaches that in Fig. 6, an electron transport compound PBD (column 8, lines 15-20) can form layer 86 (column 8, lines 30-40) which is situated between the organic photoelectric layer 88 comprising PTCDA (column 8, lines 30-35) and ohmic metal cathode 90 (column 8, lines 40-45) (page 29, lines 5-15). It is notoriously well known in the art that the ohmic metal cathode 90 serves as a cathode when the front electrode 82 serves as an anode, depending on the direction of the bias voltage.

Regarding claim 9, Forrest et al. teaches that in Fig. 6, a hole transport compound PB (column 8, lines 18-22) can form layer 86 (column 8, lines 35-40) which is situated between the organic photoelectric layer 88 comprising PTCDA (column 8, lines 30-35) and ohmic metal cathode 90 (column 8, lines 40-45) (page 29, lines 5-15). It is notoriously well known in the art that the ohmic metal cathode 90 serves as an anode when the front electrode 82 serves as a cathode, depending on the direction of the bias voltage.

13. Claims 8, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al. (US 5,315,129) as applied to claims 1-2, 5-7, 9 above, and further in view of Forrest et al. (US 6,310,360).

'129 has been discussed above, and teaches an organic optoelectronic device comprising a multi-layer structure comprised of a first electrode layer, a second electrode layer, and at least

one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, is inherently comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm, wherein the multi-layer structure is formed on one side of a substrate, and at least one of said first and second electrodes is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive. It is notoriously well known in the art that which electrode is the cathode depends on the direction of the bias voltage.

'360 teaches that the use of an exciton blocking layer in an organic light emitting device (which is a species of organic optoelectronic device) is to confine excitons within the photoelectric (luminescent) layer (column 10, lines 65-70). The excitons are responsible for the light emission in the photoelectric (luminescent) layer (column 2, lines 15-25). Thus this is done in order to provide higher light emission efficiency.

Regarding claim 8, '360 teaches that the exciton blocking layer may be situated between the photoelectric (luminescent) layer and the electron transport layer for a hole-transporting host (column 11, lines 1-5).

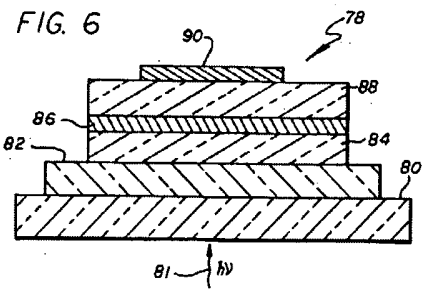
Regarding claim 10, it follows from above that for an electron-transporting host instead of a hole-transporting host, the blocking layer may be conversely situated between the photoelectric (luminescent) layer and the hole transport layer instead of the electron transport layer.

Therefore it would have been obvious to one of ordinary skill in the art to have situated an exciton blocking layer between photoelectric (luminescent) layer and either the electron transport layer or the hole transport layer in the organic optoelectronic device of '126 in order to obtain a light emitting device with confinement of the excitons to the photoelectric layer for higher light emission efficiency.

14. Claims 1, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al. (previously cited 5,315,129) in view of Jenekhe (US 5,597,890).

Regarding claim 1, '129 has been discussed above, and teaches an organic optoelectronic device comprising a multi-layer structure comprised of a first electrode layer, a second electrode layer, and at least one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, is inherently comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm, wherein the multi-layer structure is formed on one side of a substrate, and at least one of said first and second electrodes is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive.

In Fig. 6 of Forrest et al. below, the transparent electrode 82 faces the transparent substrate through which the photons 81 enter (column 8, lines 25-30), located between the source of electromagnetic radiation (photons 81) and the organic photoelectric layer 84, 86 or 88, and is thus the front electrode. Electrode 90 is thus the rear second electrode.



Regarding claim 11, Forrester et al. fails to teach that both first and second electrodes are on the same front surface of the organic photoelectric layer, instead of on opposite sides of the layer, wherein the first electrode serves as a cathode and the second electrode serves as an anode.

Jenekhe is directed to an optoelectronic (column 1, lines 15-20) device that utilizes a π-conjugated polymer (organic) (column 1, lines 29-36), which is photoelectric (optoelectric) (column 3, lines 20-21). Fig. 12 below shows the anode 26 and cathode 28 on the same surface of the photoelectric layer (polymeric film 20) (column 51, lines 50-60).

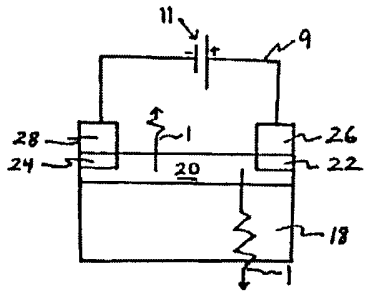


FIGURE 12

Fig. 13 on the next page shows a device of transverse geometry, wherein the anode 35 and cathode 34 are on opposite sides of the photoelectric layer (polymeric film 30) (column 51, lines 60-70).

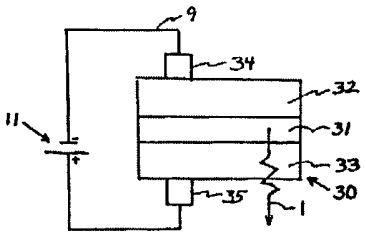


FIGURE 13

Jenekhe demonstrates that both embodiments Fig. 12 and Fig. 13 of the optoelectronic device are obvious variations and well known in the art.

Therefore it would have been obvious to one of ordinary skill in the art to have used the anode/photoelectric layer/cathode geometry in Fig. 12, where the anode and cathode are on the same surface of the photoelectric layer instead of the transverse geometry in Fig. 6 of Forrester et al. in order to obtain an alternate optoelectronic device.

15. Claims 1, 14, 17-19, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al. (US 6,198,091).

Regarding claims 1, 14, '091 has been discussed above and teaches an organic photosensitive optoelectronic device comprising a first electrode which is a front electrode and a second electrode which is the corresponding rear electrode, and at least one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, is inherently comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm, wherein the multi-layer structure is formed on one side of a

substrate, and at least one of said first and second electrodes is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive.

Regarding claims 17-18, '091 teaches that one electrode may be the cathode while the other electrode is the corresponding anode (column 26, lines 30-40). Although it is unclear which electrode, top or bottom, is the front electrode facing the electromagnetic radiation source, it is notoriously well known in the art that which electrode is the cathode and which electrode is then the corresponding anode depends on the direction of the bias voltage.

Regarding claim 19, '091 teaches in Fig. 9 that layers 905 a-d may comprise CuPc and 906 a-d may also comprise CuPc. '091 teaches that PTBCI is hole transporting (HTL) while CuPc is conversely electron transporting (ETL) (column 22, line 65). Hence there may be at least one electron transport layer situated between said organic photoelectric layers and said cathode.

Regarding claim 21, '091 teaches in Fig. 9 that layers 905 a-d may comprise PTBCI and 906 a-d may also comprise PTBCI. '091 teaches that PTBCI is hole transporting (HTL) (column 22, line 65). Hence there may be at least one hole transport layer situated between said organic photoelectric layers and said anode.

16. Claims 20, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al. (US 6,198,091) as applied to claims 1, 14, 17-19, 21 above, and further in view of Forrest et al. (US 6,310,360).

'091 has been discussed above and teaches an organic photosensitive optoelectronic device comprising a first electrode which is a front electrode and a second electrode which is the corresponding rear electrode, and at least one organic photoelectric layer, wherein said organic

photoelectric layer is an anisotropically absorbing and electrically conducting layer, is inherently comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm, wherein the multi-layer structure is formed on one side of a substrate, and at least one of said first and second electrodes is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive.

'091 teaches that one electrode may be the cathode and the other electrode is then the corresponding anode (column 26, lines 30-40). Although it is unclear which electrode, top or bottom, is the front electrode facing the electromagnetic radiation source, it is notoriously well known in the art that which electrode is the cathode and which electrode is then the corresponding anode depends on the direction of the bias voltage.

'091 teaches in Fig. 9 that layers 905 a-d may comprise CuPc and 906 a-d may also comprise CuPc. '091 teaches that PTBCI is hole transporting (HTL) while CuPc is conversely electron transporting (ETL) (column 22, line 65). Hence there may be at least one electron transport layer situated between said organic photoelectric layers and said cathode.

Regarding claims 20, 22, '091 fails to teach at least one exciton blocking layer.

'360 teaches that the use of an exciton blocking layer in an organic light emitting device (which is a species of organic optoelectronic device) is to confine excitons within the photoelectric (luminescent) layer (column 10, lines 65-70). The excitons are responsible for the

light emission in the photoelectric (luminescent) layer (column 2, lines 15-25). Thus this is done in order to provide higher light emission efficiency.

Regarding claim 20, '360 teaches that the exciton blocking layer may be situated between the photoelectric (luminescent) layer and the electron transport layer for a hole-transporting host (column 11, lines 1-5).

Regarding claim 22, it follows from above that for an electron-transporting host instead of a hole-transporting host, the blocking layer may be situated between the photoelectric (luminescent) layer and the hole transport layer instead of the electron transport layer.

Therefore it would have been obvious to one of ordinary skill in the art to have situated an exciton blocking layer between photoelectric (luminescent) layer and either the electron transport layer or the hole transport layer in the organic optoelectronic device of '126 in order to obtain a light emitting device with confinement of the excitons to the photoelectric layer for higher light emission efficiency.

17. Claims 34, 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al. (previously cited US 6,198,091) in view of Forrest et al. (US 6,451,415).

Regarding claim 34, '091 has been discussed above and teaches an organic photosensitive optoelectronic device comprising a first electrode that serves as a cathode, a second electrode that serves as an anode, and a system of organic photovoltaic cells connected in series and separated by electron-hole recombination zones, wherein each subcell comprises an organic photoelectric layer acting as an electron donor in contact with another organic photoelectric layer acting as an electron acceptor, and wherein at least one said photoelectric layer in at least one subcell inherently is an anisotropically absorbing and electrically conducting

layer, is comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm, wherein the multi-layer structure is formed on one side of a substrate, and at least one of said first and second electrodes is transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive.

Regarding claim 36, '091 fails to teach the presence of an exciton blocking layer (claim 36) situated between the electron acceptor layer and the cathode.

Regarding claim 36, '415 teaches that higher internal and external quantum efficiencies have been achieved by including in organic photosensitive optoelectronic devices (OPODs) exciton blocking layers which confine photogenerated excitons to the region (column 6, lines 65-70) near the dissociating interface and prevent parasitic exciton quenching at a photosensitive organic/electrode interface (column 7, lines 1-5). Fig. 2A of '415 shows an exciton blocking layer (EBL) 2A04 situated between the electron acceptor layer (electron transporting PTBCI) 2A03 and the cathode 2A05 (column 7, lines 55-65).

Therefore it would have been obvious to one of ordinary art to have situated an exciton blocking layer between the electron acceptor layer and the cathode of '091 in order to achieve higher internal and external quantum efficiencies.

Regarding claim 37, '091 teaches that the electrode layers may be formed of silver (Ag) (column 5, lines 20-25) which function as electron-hole recombination zones as defined by the

specification (page 38, lines 1-5, 25-30). '091 cites prior art which uses transparent metallic layers in place of Ag (column 8, lines 35-40).

'415 defines the term "transparent" as permitting at least 50 % of the electromagnetic radiation to be transmitted, and the term "semi-transparent" as permitting some but less than 50 % transmission of the desired electromagnetic radiation (column 4, lines 45-55).

'415 demonstrates that it would have been obvious to one of ordinary skill in the art to have used a semi-transparent metal layer instead of a transparent metal layer in the place of the Ag electrode of '091 in order to provide an organic photosensitive optoelectronic device with the desired light directing properties.

Regarding claim 38, '091 fails to teach that the metallic Ag layer, which is inherently electron-hole recombination zone as defined by the specification (page 38, lines 1-5, 25-30), is a region of electrically active defects.

'415 teaches that the incurrence of Ag clusters into the electron transport layer caused shorting defects which provide additional quenching regions (sites) for excitons (column 13, lines 35-45). Electrically shorting defects are electrically active defects.

'415 thus teaches that the Ag electrode of '091 which is inherently a hole recombination zone, is also inherently a region of electrically active defects.

Allowable Subject Matter

18. Claims 3-4 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The cited prior art US 5,315,129 fails to teach or suggest, even in combination with US 5,597,890 and US 5,172,385, an organic optoelectronic device comprising a multi-layer structure and a substrate, wherein said multi-layer structure is formed on one side of said substrate; a first electrode layer and a second electrode layer, and at least one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer located between the first and second electrodes, comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm; the first electrode is a front transparent electrode, being transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive, and is located between a source of the electromagnetic radiation and said organic photoelectric layer; and the second electrode is a rear reflective electrode, being reflective towards the electromagnetic radiation incident upon the device; and the device further comprises a retarder layer which is located between said reflective electrode and said photoelectric layer, wherein the thickness and optical anisotropy of said retarder layer are selected so as to ensure a 45° rotation of the polarization vector of said electromagnetic radiation.

19. Claims 12-13 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

The cited prior art US 5,315,129 fails to teach or suggest, even in combination with US 5,597,890 and US 5,172,385, an organic optoelectronic device comprising a multi-layer structure

and a substrate, wherein said multi-layer structure is formed on one side of said substrate; at least one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm; a retarder layer which is formed on the surface of said organic photoelectric layer which is opposite to a source of the electromagnetic radiation, wherein the thickness and optical anisotropy of said retarder layer are selected so as to ensure a 45° rotation of the polarization vector of the electromagnetic radiation incident upon the device; a reflective layer which is formed on said retarder layer; a first electrode layer and a second electrode layer, at least one of said first and second electrodes being transparent towards the electromagnetic radiation to which the optoelectronic device is sensitive, wherein the first electrode serves as a cathode and is formed on one part of a *front* surface of said organic photoelectric layer which is opposite to a source of the electromagnetic radiation, and the second electrode serves as an anode and is formed on another part of said front surface of said organic photoelectric layer.

Claims 15-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. US 6,198,091 fails to teach or suggest even in combination with US 5,172,385, an organic optoelectronic device comprising a multi-layer structure and a substrate, wherein said multi-layer structure is formed on one side of said substrate, and comprises first and

second organic photoelectric layers, wherein each organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm; the first organic photoelectric layer is an electron donor layer, and the second organic photoelectric layer is an electron acceptor layer and contacts with the first organic photoelectric layer forming a photovoltaic heterojunction; said first and second organic photoelectric layers are located between first and second electrodes, wherein the first electrode is a front transparent electrode located between a source of the electromagnetic radiation and said organic photoelectric layers while the second electrode is a rear reflective electrode for the electromagnetic radiation incident upon the device; and the device further comprises a retarder layer located between said rear reflective electrode and said first and second organic photoelectric layers, wherein the thickness and optical anisotropy of the retarder layer are selected so as to ensure a 45° rotation of the polarization vector of said electromagnetic radiation.

20. Claims 23-24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. US 5,315,129 fails to teach or suggest even in combination with US 5,172,385, an organic optoelectronic device comprising a multi-layer structure and a substrate, wherein said multi-layer structure is formed on one side of said substrate, and comprises at least two sequential organic photoelectric layers, wherein each organic photoelectric layer is an

anisotropically absorbing and electrically conducting layer, comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm; and wherein the polarization axes of the at least two sequential organic photoelectric layers are either mutually parallel or perpendicular.

21. Claims 30-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The cited prior art US 5,315,129 fails to teach or suggest, even in combination with US 5,597,890 and US 5,172,385, an organic optoelectronic device comprising a system of organic photovoltaic elements and a substrate, wherein said system of organic photovoltaic elements is formed on one side of said substrate, the organic photovoltaic elements being superimposed onto each other and electrically connected in parallel; a transparent cathode, a transparent anode, and at least one organic photoelectric layer, wherein said organic photoelectric layer is an anisotropically absorbing and electrically conducting layer, comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm; and wherein

(i) The substrate is transparent for the electromagnetic radiation and the device further comprises a retarder layer and a reflective layer, wherein the retarder layer is located on the organic photovoltaic element most distant from said substrate, and the reflective layer is located on said retarder layer, and wherein the thickness and optical anisotropy of said retarder layer are selected so as to provide for a 45° rotation of the polarization vector of said electromagnetic radiation (claim 30);

(ii) The device further comprises a reflective layer and a retarder layer, wherein the reflective layer is situated on the substrate and the retarder is situated between said reflective layer and the organic photovoltaic element closest to said substrate, and wherein the thickness and optical anisotropy of said retarder are selected so as to provide for a 45° rotation of the polarization vector of the electromagnetic radiation incident upon the device (claim 31);

(iii) The substrate represents a reflector having a reflection coefficient not less than 95 % for the electromagnetic radiation, and the device further comprises a retarder layer situated between said substrate and the photoelectric element closest to the substrate, wherein the thickness and optical anisotropy of said retarder layer are selected so as to provide for a 45° rotation of the polarization vector of said electromagnetic radiation (claim 33).

22. Claim 40 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The cited prior art US 5,315,129 fails to teach or suggest, even in combination with US 5,597,890 and US 5,172,385, an organic photosensitive optoelectronic device comprising a system of organic photovoltaic subcells connected in series and separated by electron-hole

recombination zones, wherein each subcell comprises an organic photoelectric layer acting as an electric donor in contact with another organic photoelectric layer acting as an electron acceptor, wherein at least one said photoelectric layer in at least one subcell is anisotropically absorbing and electrically conducting layer, comprised of rodlike supramolecules which comprise at least one polycyclic organic compound with a conjugated π-system, has a globally ordered crystal structure with an intermolecular spacing of 3.4 ± 0.3 Å along a polarization axis of said organic photoelectric layer, and absorbs electromagnetic radiation in a predetermined spectral subrange of approximately 200 to 3000 nm; a first electrode that serves as a cathode and a second electrode that serves as an anode, and a substrate that supports said first and second electrodes and at least one said subcell, wherein one of said first and second electrodes is transparent for the incident electromagnetic radiation to which the optoelectronic device is sensitive, and the other electrode represents a reflective layer with a reflection coefficient of not less than 95 % for the electromagnetic radiation incident upon the device, and said device further comprises a retarder layer introduced between said reflective layer and said system of subcells, wherein the thickness and optical anisotropy of the retarder layer are selected so as to ensure a 45° rotation of the polarization vector of said electromagnetic radiation.

Any inquiry concerning this communication should be directed to Sow-Fun Hon whose telephone number (571)272-1492. The examiner can normally be reached Monday to Friday from 10:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon, can be reached on (571)272-1498. The fax phone number for the organization where this application or proceeding is assigned is (703)872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Hon.

Sow-Fun Hon

07/27/04